DOCUMENT RESUME

ED 323 009 PS 019 013

AUTHOR Irington, Janice
TITLE Walk around the Clock: Third Grade Students Learn To Tell Time.
PUB DATE Jul 89
NOTE 78p.; Master's Practicum Report, Nova University. Sections in appendix containing photographs and small, marginally legible print may not reproduce clearly.
PUB TYPE Dissertations/Theses - Practicum Papers (043)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Elementary School Students; Games; *Grade 3; *Learning Activities; Learning Problems; *Learning Strategies; *Playground Activities; Playgrounds; Primary Education; Program Descriptions; *Time
IDENTIFIERS *Time Telling

ABSTRACT

A primary education specialist designed and implemented a 10-week practicum intervention intended to teach third-grade students how to tell time. Eight students who experienced considerable difficulty in telling time by 5- and 1-minute intervals participated in the study. Students learned to tell time through classroom and playground activities that involved use of a clock face made of cement stones built into the school's playground. While the intervention did not meet all objectives at the levels set, evaluation data indicated that in general the practicum was effective. During implementation, observation suggested that primary children need to work with large objects and pictures. Both mechanical and simulated clocks should be large so that children can easily see numerals and markings. Prominent among appended materials are the third grade mathematics program objectives, the county's standardized test on telling time, teachers' and students' surveys, pre- and post-tests, discussion questions and student responses, and directions for constructing the model clock and playing the Around the World game. A newspaper article, with photos of the playground clock, is also appended. (RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☒ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED323009

WALK AROUND THE CLOCK: THIRD GRADE STUDENTS LEARN TO TELL TIME

by

Janice Irington

A Practicum Report
submitted to the faculty of the Center for the
Advancement of Education of Nova University in
partial fulfillment of the requirements for the degree
of Master of Science

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Janice Irington

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

The abstract of this report may be placed in a
national database system for reference.

July 1989

PS 019013

BEST COPY AVAILABLE

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my work, presented here, will earn similar respect.

Signed Janice Arrington

Abstract

Walk Around The Clock: Third Grade Students Learn To Tell Time.
Irington, Janice, 1989: Practicum Report, Nova University, The Center for the Advancement of Education.
Descriptors: Mathemathics Skills for Primary Education/Measurement Techniques for Primary Education/Piagetian Theories/Concrete-Operational Thought/Time/Piagetian Measurements/

Although time-telling has been an essential part of the curriculum since kindergarten, there were third grade students at the practicum site who were unable to tell time by five and one minute intervals. Results from a student survey, teacher survey and a county standardized test confirmed this statement. Since telling time is an abstract concept, a more concrete approach was used in presenting the skill. Piaget's theory that logical ideas can be applied and understood if presented in concrete form was the basis for teaching this concept. The goal for this practicum was to improve the targeted students' ability to tell time by walking around a clock made of cement stones. The different approach was successful and enjoyed by the students. The staff was fully aware of the clock's presence and the availability of its use. An article concerning this project was published in the local newspaper. Included in the Appendices are: diagrams, activities, directions, a story, results of surveys and discussions, tests, photographs and a newspaper article.

Table of Contents

Page

Title Page..... i

Authorship Statement..... ii

Abstract..... iii

Observer's Verification..... iv

Chapters

I. Purpose..... 1

II. Research and Solution Strategy..... 12

III. Method..... 26

IV. Results..... 41

V. Recommendations..... 45

Reference List..... 46

Appendices..... 47

Appendix A: Third Grade Math Curriculum..... 49

Appendix B: County Standardized Test..... 51

Appendix C: Teacher Survey-Math Skills..... 53

Appendix D: Teacher Survey-Students' Ability.. 55

Appendix E: Parent Permission Letter..... 57

Appendix F: Student Survey 59

Appendix G: Piaget's Test of Conservation..... 61

Appendix H: Posttest- Five Minute Intervals... 63

Appendix I: Posttest-One Minute Intervals.... 65
Appendix J: Discussion-Need for Clocks..... 67
Appendix K: History of Clocks..... 69
Appendix L: Discussion on Telling Time..... 71
Appendix M: Semantic Mapping..... 73
Appendix N: Construction of Model Clock..... 75
Appendix O: Directions for "Around the World" 77
Appendix P: Results of Using Clocks..... 79
Appendix Q: Telling Time-Five Minute Intervals 81
Appendix R: Telling Time-One Minute Intervals 83
Appendix S: One and Five Minute Intervals.... 85
Appendix T: Second Student Survey..... 87
Appendix U: Posttest-Five Minute Intervals... 89
Appendix V: Posttest-One Minute Intervals.... 91
Appendix W: Results-Practicum Objectives..... 93
Appendix X: Newspaper Article..... 95
Appendix Y: Photographs of Clock & Students.. 97

CHAPTER I

Purpose

Background

This practicum takes place in an elementary school, located in the southeastern part of the United States. The practicum site was originally an "open school" plant that implemented the "open school" philosophy. However, over the years, the "open" plant has evolved into quasi self-contained classrooms and the "open" philosophy has been replaced by traditional teaching styles.

Although the school is situated in a middle-class neighborhood, a large portion of the 604 students are bussed in from a low socioeconomic area. The Black and Caucasian ratio is 51 percent and 44 percent respectively. Five percent of the student body is Spanish-American. Forty-six percent of the students receive free lunches. The student-teacher ratio is 25 to one in kindergarten; 28 to one in first through third; and 32 to one in fourth and fifth grades.

There is minimal parent participation in the school volunteer program, P.T.A., and Advisory Committee. The majority of the parents work outside the home. Others are unable to actively participate because of younger children. For these parents, additional time for school involvement may be limited.

The "after school" care program has 46 children presently enrolled. In addition, four private day care centers also provide after-school supervision. For many children, private day care centers also supervise them before school as well.

In addition to the regular classes and special programs, the school provides instruction for students with high intellectual ability and also two classes for specific learning disabilities. A Dropout Prevention Program and two Chapter I classes are also in operation at this school.

The writer is employed as a Primary Specialist. This position does not maintain an instructional classroom but does require interaction with students from kindergarten through third grade. Along with academic testing and screening students for vision and hearing difficulties, the duties include assisting

students who need additional help beyond the classroom instruction. Many of the students at the practicum site have difficulty understanding concepts when presented in a group setting. One of the responsibilities of the Primary Specialist is to pull those children from the classroom and provide them with instruction.

There are a number of skills which present problems to some children year after year. One such skill is telling time. For some second and third grade students, it is a difficult concept to comprehend. Results from tests and teacher observation show this to be true.

Problem Statement

The skill of telling time is introduced as early as kindergarten and it is an essential part of the math curriculum for grades one and two. By the time students reach third grade, they have been instructed on this skill for three previous grades. Yet, results from a teacher survey, standardized test and a student survey show that students are not prepared to solve time-telling problems which they are expected to perform at this level.

The county curriculum for third grade expects students to have mastered the basic skill of telling time. The present program not only requires students to tell time by five and one minute intervals but to apply those skills in performing more complex problem solving (Appendix A:49). For example, students are presented with problems which involve the calculation of hours and minutes. They are also required to use a timetable to solve word problems and when given the number of minutes before or after a given time, students are expected to determine the precise time of day. In order to perform the above skills, children must first have mastered the basic knowledge and obtained a firm and solid understanding of time-telling. However, last year, at the end of the unit on telling time, a county standardized test was administered. Results revealed that forty-two percent of the third grade students did not pass. That is, they failed to answer 75 percent of the items correctly (Appendix B:51).

In Smith's (1987) book on teaching children to tell time she stated in her introduction:

> Most elementary teachers who have taught time-telling skills will agree that these mathematics

> skills are among the most difficult for students to learn. Learning to measure time is a challenge for young students. Time-telling skills are also difficult for students to retain. Few elementary math concepts are as abstract as telling time. Smith (1987:v)

Second and third grade teachers at the practicum site were asked to name the math skills they felt were the most difficult for their students to understand (Appendix C:53). Among the various skills that were listed, telling time appeared on all responses.

The same group of teachers completed a survey on their students' ability to tell time (Appendix D:55). All six teachers felt that 90 percent of their students could tell time by the hour and half-hour. They were also confident that their students knew the number of minutes in an hour; the number of minutes between each number; and the names of the two hands. Those percentages were in the range of 90 to 100 percent of their students. However, their expectations dropped to 30 percent when surveyed on the number of students who were able to tell time by five and one minute intervals.

For participation in this practicum, parent permission was obtained (Appendix E:57). Sixty-seven third grade students completed a survey on their

ability to tell time (Appendix F:59). Results showed that seventy-six percent felt confident in their ability to tell time. According to the survey, more than half of the students have a basic foundation for telling time. However, there is a small percentage of third grade students who need more instruction on the basic knowledge of this concept. Thirty-three percent did not know the names of the long and short hands. Thirty percent were unable to correctly state the number of minutes in an hour; and 40 percent responded incorrectly to the number of minutes between each number. Thirty-three percent had not learned that 2:30 and half past two were the same.

One part of the student survey contained eight clocks. Students were asked to write the correct time for each. Results of the survey revealed that 40 percent knew how to tell time with accuracy; 16 percent were questionable; and 43 percent definitely had not mastered the skill of telling time by five minute intervals.

The goal of this practicum was twofold. The first was to explore for possible reasons as to why this skill presents such a problem to some children.

The second was to develop a solution to correct the problem. A number of possibilities existed.

In a survey of the third grade classes, children were asked to indicate the number of "hand clocks" and digital clocks in their homes. According to the responses, more digital clocks could be found in 54 percent of the homes than "hand clocks". The prevalent use of digital clocks in today's society could be a contributing factor in children's lack of time-telling skills. The need to tell time by a "hand clock" is not essential in today's world.

Elkind (1981), a professor at Tufts University, feels that the general use of digital clocks in schools is because they make it easy for children to tell time. The numbers are in plain view and all the child needs to do is to look. To tell time by the clock face, logical thinking is needed to translate the position of the hands into the time of day. He stated, "The real danger of the digital clock is the assumption that, by making a task easier, we thereby make children brighter." Elkind (1981:77)

Another reason for the problem could be because the concept is too abstract and children of this age

are not developmentally ready.

> The child development studies of Jean Piaget indicate that most children will not be able to understand the complex concepts of time and the relationship of two moving clock hands until the children are about nine years old. (Smith 1987:v)

Kamii, a professor of Early Childhood Education at the University of Alabama at Birmingham, feels that children are taught skills before they are ready simply because the skill will be tested on an achievement test. She gave her views on similar skills. Kamii (1985) stated:

> In arithmetic, for example, place value is taught not only in first grade but also in second grade, third grade, fourth grade, fifth grade and sixth grade! It is amazing to me that no one in the Educational Establishment has noticed that there must be something profoundly wrong if the same thing has to be taught every single year in the first six grades. Place value ought to be outlawed in the first two grades, along with missing addends, because it is cognitively impossible for most young children to understand. Kamii (1985:8)

Children in this school system are introduced to telling time in kindergarten and the instruction continues through fifth grade.

The targeted students for this practicum were given four of Piaget's tests on conservation (Appendix G:61). The results indicated that these children are in the transitional stage between

Piaget's preoperational and concrete stages of development.

According to Piaget's theory of cognitive development, a person can understand and apply logical ideas when presented in concrete form (Berger 1980:543). In the teacher survey, second and third grade teachers were asked to list the items or supplementary material used in teaching children to tell time. The materials included Judy Clocks, dittos, oral games, individual student clocks, beads, quarters, textbooks, real clocks, digital clocks, "hour-only" clocks and clock stamps. In light of Piaget's theory, perhaps a more concrete approach needs to be taken with the third grade students who have not mastered time-telling skills. A new and different technique may be needed to make this concept more understandable to the targeted students.

Targeted Students

Eleven students were targeted for this project. However, only eight completed the implementation. One student moved between completing the survey and beginning the implementation. After one week, another student decided not to participate; and a

third student moved after seven weeks into the implementation.

Six of the selected students were males and five were females. Five of the students were Black, five were Caucasian, and one was Spanish-American. Two children have been retained at least once and four have spent a year in prefirst. Among the 11 targeted students, four had been enrolled at other schools before entering this one. One of the eleven children attends Chapter I.

Outcome Objectives

The goal for this practicum was to improve time-telling skills with a group of third grade students. There are prerequisite measurement skills which the targeted students should have mastered in previous grade levels. In order to overcome this deficiency, the following objectives were proposed:

1. Over a 10-week period, approximately 90 percent of the participating students will learn the basic knowledge for telling time such as the names of the long and short hands; the number of minutes in an hour; and the number of minutes between each number. The improvement will be measured by students repeating

the student survey (Appendix F:59). These students will improve their scores by 85 percent.

2. Over a 10-week period, 80 percent of the participating students will be able to tell the correct time by five minute intervals, as measured by repeating the student survey (Appendix F:59) and a posttest (Appendix H:63). The students will improve the student survey score by 75 percent.

3. Over a 10-week period, 75 percent of the targeted students will be able to tell the correct time by one minute intervals. Seventy percent of the posttest (Appendix I:65) will be answered correctly.

CHAPTER II

Research and Solution Strategy

Research has shown that young children have difficulty learning to tell time. James Heddens (1984) stated:

> Do not rush children into reading clocks, because it is a very abstract and difficult task. Do not teach "quarter after," "quarter past," or "quarter to." A child knows a quarter as twenty-five cents; suddenly his teacher wants him to know it as fifteen minutes. So as not to confuse him, reserve "quarter" for money. Heddens (1984:437)

Smith's (1987) approach to teaching time-telling skills is in her book's title, <u>One Hand at a Time</u>. The emphasis is first placed on the hour hand and its function. By using the hour hand only, children learn to tell time by the hour, half-hour and quarter hour. When this is mastered, the minute hand is introduced and children learn the relationship of the two hands and how they work together.

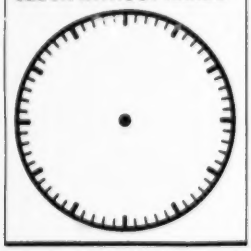
Smith (1987) recommends that her approach not be used with methods that use the two hands approach. She stated, "It can be used effectively as an alternative approach for remedial elementary students,

and it can serve as the basic program for special education students of all ages." Smith (1989:v) This approach uses a story about time to introduce each of the seven units. The stories and activities help to integrate mathematics with other areas of the elementary curriculum - social studies, language arts, and science. Ideas for bulletin boards and worksheets are also provided.

Krustehinsky and Larner's (1988) method of teaching time-telling skills is somewhat different. Their method is to use a clock with no hands and no numbers as shown in Figure 1.

Figure 1

CLOCK WITHOUT HANDS



Students learn to tell time by first learning to count minutes. Children start at an arrow, located in the position of the number "12", and are asked to count the number of minutes past the arrow. When this is mastered, the students draw the minute hand.

Children are made to understand that the clock consists of an inner and outer circle. The function of the hour and minute hands are explained. Children are also instructed on the relationship the two hands have to the inner and outer circles. It is also explained that when the hour hand is between two numbers, it belongs to the lower number.

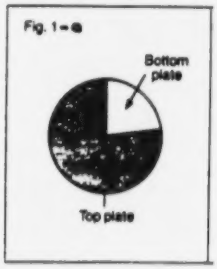
"Breaking down the concept of telling time into outer and inner circles removes sources of confusion. It then makes sense to have two hands, both different lengths, pointing to numbers in the outer and inner circles." Krustehinsky and Larner (1988:41)

Krustehinsky and Larner's approach was used successfully with a class of disabled students. "With plenty of practice counting minutes, the children could tell time as soon as the hour hand was introduced." Krustehinsky & Larner (1988:41)

Another approach in teaching time-telling skills is presented by Virginia and Willis Horak (1983). Their method uses slit clocks. Figure 1-a, on the following page, illustrates the procedure.

> All slit clock faces are constructed similarly. The fronts of two paper plates are painted in contrasting colors. The two plates are stacked and a cut is made in both of them from the edge

contrasting colors. The two plates are stacked and a cut is made in both of them from the edge to the geometric center. Hold the two plates so the slit is vertical at the top of the plate. Open the slit, raising the left side of both plates. The bottom plate is then rotated clockwise as it comes from behind and covers the front plate. Horak & Horak (1983:9)



The Horaks feel that teaching time to primary children should first consist of activities that help children understand the concept of time and then use activities that involve telling time. This approach uses five activities for this purpose.

1. To teach short durations of time, children make pictures of various events that happen in their day. The pictures are then placed in the order of their occurrence.

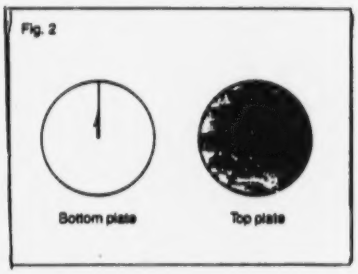
2. For concepts of longer periods of time, seeds or sprouts are grown. Children draw pictures of the sprout or plant at frequent intervals, over a two week period. The pictures are then put in the order in

3. To compare durations of time, children make guesses as to which activity takes the most time: eating breakfast or eating dinner, riding a car or riding a bus. The guesses can be checked by doing each of the activities.

4. From one-minute experiences, children estimate one minute intervals by putting their heads down and raising them when they think one minute has passed.

5. Children extend the above activity by estimating longer periods of time. This could include estimating the amount of time it takes to play a game or the length of time from lunch to dismissal.

When children develop a good concept of time, they are ready to begin the activities which will help them learn to tell time. Three different slit clocks are used. At the beginning, children will be working with the hour-face clock which is shown in Figure 2. The arrow on the bottom plate indicates the hour hand.



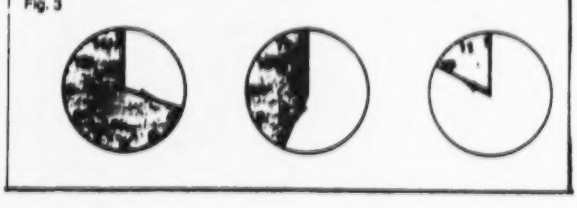
Using slit clocks, the following is a brief explanation of activities used by Horak & Horak to teach time.

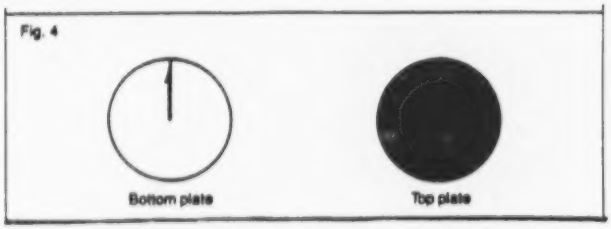
1. Children are directed to rotate the bottom plate so the arrow will point to various numbers. It is explained that these are "on-the-hour" times. When children have mastered this concept, they are ready for the "before" and "after-hour" times. "Children need much practice on this activity so that later they will look first at the hour hand when they are reading clocks like those in Figure 3." Horak & Horak (1983:10)

2. Children are asked to demonstrate where the arrow should be when it is time for specific events of the day. These could be lunch, free time, dismissal or any number of other activities.

3. The class is divided into two groups. One group is directed to display a specific time of day. The other is to display the time showing two hours later.

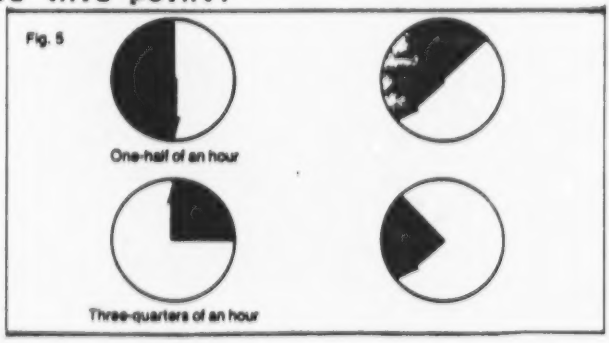
Fig. 3





Activities used to teach minutes include:

1. Before learning to tell time by the minutes, children first learn the location of the minute hand to show the "common fractional" parts of a clock (see Figure 4). The bottom plate is rotated one full turn to show the passing of one full hour. Children learn that one full turn can begin anywhere. This activity also includes practice on recognizing half and quarter hours. "Throughout this activity, the teacher must focus the children's attention on the colored fractional parts of the circle, not on the location of the clock hand." Horak & Horak (1983:11) Figure 5 illustrates this point.



2. This activity teaches time-telling by five minute intervals. "The teacher and children rotate the long-hand plate, stop at the marked positions, and simultaneously count by fives." Horak & Horak (1983:11)

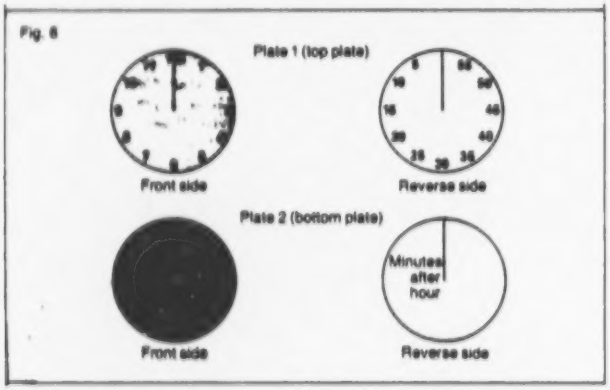
3. Another slit clock is used for this activity, along with the one shown in Figure 4. The second set's top plate is marked with lines at the five minute intervals. The bottom plate is marked with the long hand or the left side of the slit.

Students rotate the unmarked plates into the quarter-hour position. They then rotate the marked clocks to show the same area. "Thus the children can see that one quarter of an hour is the same as 15 minutes: a fractional part of an hour is simply renamed as so many minutes." Horak & Horak (1983 '1)

4. This activity involves counting 30-minute intervals. Times from 15 to 45; from 25 to 55; or from 10 to 40 could be used. This could be extended to involve finding intervals of 20 minutes, 45 minutes, or 50 minutes.

The Horaks' program includes clocks for self checking and a different set of slit clocks are used.

The top plate is divided into 12 segments and numbered from one to 12. The multiples of five, from 5 to 55, are written on the reverse side of this plate at the usual intervals and in counter clockwise direction. That is, the numeral 5 will be directly in back of the 1, the 10 directly in back of the 2, and so on. The bottom plate has the usual long arrow marked along the left hand edge of the slit on the front side. On the reverse side of this plate, the words "minute after hour" are written along the the left-hand edge of the slit. See figure 6 for illustrations. Horak & Horak (1983:11)



The Horaks feel that it is necessary for children to associate the five-minute intervals with the locations around the clock. For example, when the long hand points to the five, the child knows that it means 25 minutes.

By learning to tell time, using the hour and minute hands separately, children begin working with two-minute clocks. Old clocks are suggested at the beginning.

Children use clocks with movable hands so they can practice positioning the hands to show specific times. Equally as important, children should also be able to show impossible combinations as shown in Figure 7.

Fig. 7

Lipstreau and Johnson's (1988) approach to telling time was used with disabled students. The disabilities ranged from moderate to severe with IQ's from 40 to 50. Prerequisite skills are the same as for other methods of teaching the skills. It is necessary for students to recognize numbers from one to 12 and be able to count by fives.

Real clocks are used with this method. No worksheets or student-made clocks are used. Students start with learning to tell the time by the hours, then to five minutes after the hour. An important feature of this method is that a review of previously

learned time intervals always precedes the new lesson to be taught. "Times between the hour and half hour are learned more rapidly than the times after the half hour, since the position of the hour hand can cause confusion." Lipstreu & Johnson (1988:11)

With any method of instruction, the following three mistakes are the most common: calculating the incorrect number of minutes, deciding on the wrong hour, and confusing the hands.

> The important method of intervention is practice in generalization. This procedure may be used to correct any of the three most common errors. Rather than an involved teacher explanation, generalization instruction provides the student with practice on specific items missed. If, for example, the student identifies a time as 3:20 instead of 3:10, the teacher will tell the student the correct time, have the student repeat it, and then provide the following practice times: 9:10, 6:10, 1:10 and 4:10. This allows the student to intergrate the learning naturally. Lipstreu & Johnson (1988:12)

According to the writers of this article, "Students should never be taught the various ways to say a specific time (e.g.,4:45, 15 minutes to 5, quarter to 5) until one entire system is mastered completely." Lipstreu & Johnson (1988:12)

Lipstreu and Johnson's method has been successful with a wide range of students with learning

disabilities. The method helps students see the clock as a whole. It presents time-telling in a sequential manner that blends naturally into functional living." Lipstreu & Johnson (1988:12)

Friedman and Hofmeister (1984) developed a microcomputer/video based instructional system (MCVD) developed to provide individualized instruction to handicapped students. It uses teacher and technology together, to assist these students in various subject areas, one of which is telling time.

This program on time-telling is usually completed in six weeks. Students learned to tell time with 80 percent accuracy and involved little to no teacher time. It was adapted from a paper and pencil program. The MCVD program's instructional objectives are designed to teach time-telling to the nearest five minute intervals.

Before starting the program, children need to recognize numbers 0 - 60 and count by fives. Students receive immediate feedback to their answers. The remediation for wrong answers consists of correction procedures and reverts back to previous instruction. Students are only advanced when responding with at

least 80 percent accuracy.

This program was tested with four students who were in first and second grades. Three had learning disabilities and one was educably mentally retarded. All four could count to 60 by ones and fives and could recognize written numbers. According to the pretest, none of the students could tell time. They worked on the MCVD program in one area of the room for approximately 15 minutes per day and received no intervention from the teacher. The program was completed in four weeks. Three different posttests revealed that the students exceeded the 80 percent accuracy required.

For this practicum, the strategy to be used has been designed by the writer. However, several ideas were obtained from the review and have been incorporated into the previous plan. For some children, learning to tell time poses little or no difficulty. To others, this concept is extremely difficult, if not close to impossible. The latter group of children is the concern for this project.

For years, in addition to the textbook, teachers have used clocks with movable hands, flash cards with

clock faces, real clocks, commercially made gimmicks, and worksheets to teach students how to tell time. For some children, these methods do not work. Perhaps an entirely different approach is needed when teaching students to tell time. Piaget's theory suggested that a person can understand and apply logical ideas when presented in concrete form (Berger, 1980:543). The strategy for this practicum was based on this theory. Since telling time is such an abstract concept, perhaps children might obtain a better understanding if it could be presented in the simplest of concrete terms.

The strategy to be implemented is one with a more basic and concrete approach in presenting the skill. Although this project will be implemented outside and will remain permanently on the playground, the idea can be modified for use in a classroom. The goal for this approach is to improve the time-telling skills of the targeted students.

CHAPTER III

Method

Since telling time is an abstract concept and a difficult one for some children to understand, an entirely different approach has been used for this practicum. The strategy was based on Piaget's theory that logical ideas can be applied and understood if presented in concrete form.

The following is an outline of the method used for this project:

I. Introduction

II. Inside Activities on Telling Time and Using Clocks

III. "Outside Clock" Activities

IV. Follow-Up Inside Activities

V. Evaluation

I. INTRODUCTION

History of Clocks
Week One - February 8 Session

The first session consisted of a discussion concerning the importance of clocks. The discussion resulted from the following questions (Appendix J:67):

1. Do we need clocks in our lives today?
2. Have we always had a need to know the time of day?
3. Have we always had clocks around to let us know the time of day?

A history of clocks, referenced in Smith's, (1987) book on telling time, was told to the students (Appendix K:69), followed by a discussion of the story. Four students remembered having heard about sundials but could recall no further information. They were familiar with the sand clock because many children's games contain these kinds of timers. However, the clock candles and water clocks seemed to have held more interest. None of the students had heard of these time-telling devices.

Questions About Clocks and Time
Week One - February 8 Session

Although results from the teacher and student surveys were used to determine the strategy for this project, it was also necessary to talk with the targeted students. It was important to get their input as to why this concept was so difficult for them to understand.

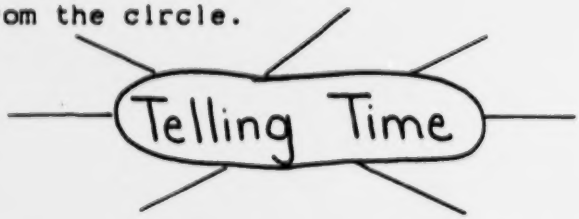
A discussion resulted from the following questions (Appendix L:71):

1. Do you remember what you learned about telling time in the first and second grades?
2. How do you tell time?
3. What is it about telling time that is difficult for you? Why?
4. How do you know when to leave home for school or go to the bus?
5. Is it important to be able to tell time? Why?

II. INSIDE ACTIVITIES ON TELLING TIME AND USING CLOCKS

Semantic Mapping
Week One - February 9 Session

A large piece of butcher paper was used for this activity. Encircled in the center of the paper were the words "Telling Time". Straight lines extended outward from the circle.



Students were directed to call out words they associated with telling time. As each word was called, it was written on the paper. When the list was completed, students were asked to find words that were related. These words were written at the end of

the extended lines. The related groups were then categorized, named, and written on the lines extending from the circle (Appendix M:73).

"Fun" and "Not Fun" began as two separate categories. However, the students were unable to agree upon which activities were "Fun" and those which were "Not Fun". Activities that some students thought were fun were not considered fun to other students. It was decided that a "Fun/Not Fun" category be created.

How Long Is A Minute?
Week One - February 10 Session

As suggested by Horak & Horak, students voiced their opinions as to whether a minute was a long or short period of time. The answers ranged from "not very long" to "sometimes it seems real long". One student explained that it seemed long when the teacher made him put his head on the desk for talking. "When the class is outside and I have to sit down, a minute seems like a real long time," remarked another student. Many students agreed that time passes more quickly when they are involved in enjoyable activities.

In order for the students to get an idea as to the length of a minute, they were directed to stand for one minute and to sit down when they thought the minute had passed. Students were also asked to stand on one foot for one minute, and to hold their breaths for that same length of time. Students were then assigned partners. The participating partners were to decide if they could count to fifty in one minute (Barson & Barson, 1987). As the activity was performed, their partners noted the time by watching the second hand of a wall clock. Times were then compared. The following activities were done in the same manner as described by Barson & Barson (1987).

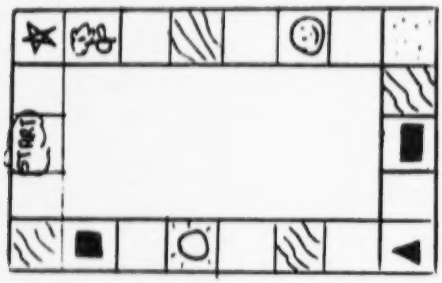
1. Write own name ten times.
2. Count backwards from 30 to zero.
3. Take shoes off and put them back on again.

Simulated Board Game
Week Two - February 13 Session

It was explained to students that telling time was similar to some board games. In doing both, counting begins at a definite spot on the board and continues until a designated place is reached. A board game was used to illustrate this idea. A

diagram can be found below.

Students were directed to begin at "START" and count the number of blocks to a designated picture. Each child had a turn at counting and had no trouble in performing this exercise.



Observe a Real Clock
Week Two - February 15 Session

A mechanical clock was used for students to observe the hour and minute hands. They were directed to closely observe the movement of the hour hand while the minute hand made one complete turn around the clock. The minute hand was moved four complete turns so students would be sure to notice the location and movement of both hands.

Students were told that both clock hands are needed for telling time correctly. It was further explained that the short hand was called the hour hand and only reached the numbers which represent hours.

The minute hand was longer, it moved faster, and touched the smaller marks which represent minutes.

Students called out various times and the teacher positioned the hands to display those times on the mechanical clock. The position of each hand was emphasized.

III. "OUTSIDE CLOCK" ACTIVITIES

Counting Minutes
Week Three - February 21 Session

Children were taken outside to the model clock made of cement stones (Appendix N:75). It was explained that the game they were about to play was similar to time on a clock. They would begin at "START" and count to the designated number. Masking tape was placed across the round cement stone which was in the position of the number "12" on a clock. "START" was written on the tape and students were directed to begin at that stone.

The students were placed on "START" and directed to count aloud as they stepped on each stone. After establishing that 60 cement stones were displayed to form the clock, one student walked half way around while the others counted. It was explained that if

they could walk on a clock, they would step on 60 marks.

Counting By Fives
Week Three - February 22 Session

The second day outside, students were asked to count the number of blocks between each round stone. Students needed to be reminded that when they stepped forward, from "START", the next block was the first. These students were in the habit of counting the block on which they were standing as the first one.

Although students could count by fives to 100, the group also reviewed the meaning of counting by fives. It was explained that this way was faster and they would be less likely to miscount. Students were then directed to leap from one round stone to another, counting by fives as they leaped. The group enjoyed jumping around the clock and was permitted to repeat the procedure.

Following leaping by fives, the teacher called out various numbers from one to 30. The students volunteered to begin on "START" and walk to the designated number, counting aloud as they stepped on each block.

Week Three - February 23 Session

During the latter part of the third week, numbers were painted on the round stones from one to 12. It was explained that "START" had been removed and the starting point would be "12". As students stood at the bottom, outside the clock circle, they were asked to tell the number of minutes from "12" to various designated numbers around the clock. If they responded incorrectly or had trouble counting the correct number mentally, they were allowed to walk and count. They were always permitted to walk and count anytime they wished. This was true throughout implementation.

Outside Clock Game
Week Four - February 28 Session

The group reviewed the concept observed earlier with the mechanical clock. It took the minute hand one complete turn around the clock while the hour hand moved only to the next number. The students observed the mechanical clock again, noting the movement and location of the two hands.

At the beginning of each session outside, the first few minutes consisted of students reviewing

the number of minutes in an hour, a half hour, and minutes between numbers. The names of the hands and their purpose also were reviewed.

The minute hand only was first used on the "Outside Clock". The hand was moved in a clockwise direction and placed at various numbers around the clock. Children were asked to tell the number of minutes, starting at 12. Again, students were always permitted to count, if they felt it was necessary.

Week Four - March 1 Session

The students were encouraged to count by fives instead of ones. Again it was explained that they would be less likely to miscount because there were fewer items to count. Students also were encouraged to associate each number on the clock with a certain number of minutes. They were directed to think of the "3" in terms of 15 minutes; "5" with 25 minutes; "8" with 40 minutes, or "10" with 50 minutes.

This session consisted of placing the minute hand at various points around the clock and students volunteering to call out the number of minutes past the "12".

Week Four - March 2 Session

On the previous day, three students were having some difficulty counting the minutes correctly. On this day, only those three students came outside. The number of minutes in an hour and counting by fives were reviewed. The minute hand was placed at various locations around the clock and they helped each other count the minutes.

Week Five - March 8 Session

Beginning with this session, the hour hand only was placed on the clock. It was explained to the students that it is important to notice the location of the hand. They were taught to decide if the hour hand was on or past a number. If it were past, they were to identify the number. Students appeared to understand this concept.

Week Five - March 10 Session

Both hands were used on the clock and placed at various positions. The minute hand displayed only five minute intervals for this session. The teacher reminded students to observe the location of the hour hand. If the hand had passed a number, they were to

count the number of minutes from "12" to the point where the minute hand rested.

Week Six - March 14 Session

The hour and minute hands were moved by the teacher to display various times on the clock. The hands displayed five and one minute intervals past the hour. Individual students were called upon to respond. If they responded with an incorrect answer, they were directed to recount.

At the end of this session, the students were introduced to the game "Around the World". The directions can be found in Appendix O:77.

Week Six - March 16 Session

Four students were taken outside for this session. They had experienced difficulty distinguishing between the hour and the minute hands. The round cement stones were moved towards the center of the clock and the brick-shape stones were moved outward so the minute hand would touch only the bottom portion of the stone.

Week Seven - March 20 & 22 Sessions

The first part of each session consisted of both hands being positioned at various points around the

clock. Students were called upon to give the correct time. They would be reminded where to look first, what to observe, and to count the number of minutes.

During the second part of each session, students were directed to position the hands to show a certain time, as requested by the teacher or another student.

On March 22, after coming inside, two rounds of "Around the World" were played at the students' request.

Week Eight - April 5 & 6 Sessions

The teacher called students from class individually. Using a mechanical clock to display various times, each student was asked to give the correct time. Some of the students had difficulty with the activity.

A play clock was used the following day and the same procedure was followed. The students did not encounter the same difficulty as they experienced the previous day (Appendix P:79). The students having difficulty explained that it was more difficult to count the minutes on the real clock.

The real clock was smaller, seven inches in diameter. Therefore, the marks representing the minutes were also smaller. The raised, flat-glass

covering made it difficult for students to place their fingers near the minute-markings in order to count.

IV. FOLLOW-UP INSIDE ACTIVITIES

Week Nine - April 9 Session

Following the game "Around the World", students completed a ditto sheet involving telling time by five minute intervals (Appendix Q:81).

Week Nine - April 12 Session

Students were given lap boards, chalk and erasers. The teacher used a play clock to display various times involving five and one minute intervals.

This activity was followed by students completing a ditto sheet involving time-telling by one-minute intervals (Appendix R:83). Students complained that the minutes were difficult to count.

Week Nine - April 13 Session

Students were given miniature play clocks. A time was called by the teacher and students positioned their own clock to display that specific time.

At the request of the students, three rounds of "Around the World" were played by the group. Students were then asked to complete two ditto sheets involving time-telling. The sheets contained a mixture of clock faces displaying times of one and five minute intervals (Appendix S:85).

V. EVALUATION

Week Ten - April 18 Session

The targeted students completed the Student Survey for the second time (Appendix T:87).

Week Ten - April 19 Session

A test was administered to measure each student's skill at time-telling by five-minute intervals (Appendix U:89).

Week Ten - April 20 Session

The students were administered a test to measure time-telling by one-minute intervals (Appendix V:91).

CHAPTER IV

Results

Objective One

The student survey which served as a pretest was used as a posttest to measure the improvement of such skills as: the names of the long and short hands; the number of minutes in an hour; and the number of minutes between each number. Ninety percent of the targeted students improved these skills by 100 percent (Appendix W:93). The objective was for 90 percent of these students to improve the above skills by 85 percent.

Objective Two

The second objective was for 80 percent of the participating students to improve their ability to tell time, at five minute intervals, by 75 percent. The student survey was to be used to measure the improvement and also a posttest was to be given.

Upon completion of the student survey, only 50 percent of the students improved by 75 percent (Appendix W:93). An additional test was administered

to test this skill and 50 percent of the group answered 100 percent correctly; 13 percent answered 90 percent correctly; and 38 percent answered 80 percent correctly.

Objective Three

Students completed a posttest to measure time-telling skills by one-minute intervals. Seventy-five percent of the targeted students were expected to answer 70 percent of the posttest questions correctly. The results of the posttest revealed that 62 percent of the students answered 100 percent of the test questions correctly; 13 percent answered 90 percent correctly; and 25 percent answered 80 percent correctly (Appendix W:93).

Discussion

The goal for this practicum was to explore possible reasons as to why telling time was so difficult for some children to understand and to develop a solution to correct the problem.

Logical thinking is needed to tell time by the face of a clock. The process requires students to translate the position of the hands into the time of

day (Elkind, 1981:77). For some children, this is an extremely difficult task.

In order to perform this process, a student must first understand the basic mechanics of time-telling. The traditional method of presenting this concept has not been successful for all students. For those who are unable to think abstractly, a more concrete, manipulative, "hands-on" approach is needed.

As results have indicated, the above method was successful in teaching this concept. It explained the process in the simplest of terms, therefore making the concept easier to understand. The "Outside Clock" was different, enjoyable and inexpensive to construct. With some creativity and imagination, this idea could be modified for use in the classroom.

During implementation, minor changes were made from the original plan. As the project progressed, a few ideas and activities were inserted and deleted to improve the strategy.

The observation was made during the project that primary children need to work with large objects and pictures. Mechanical clocks as well as simulated ones need to be large so children can easily see the

numbers and markings on the faces. This is true with the printed page as well. Students seemed to perform with more ease when using the large clock faces.

This particular project may have met with more success had the sessions been held daily for a shorter period of time, rather than meeting sporadically over a longer period of time. Activities from the previous day may have been better retained by the students.

Observation of Students

The inconsistent performance of two students presented a reason for concern. During some sessions, Student 2 and Student 8 would answer with nearly 100 percent accuracy. Other sessions, the two would seem totally confused. From discussions with the students' teacher, the same behavior has been observed in the classroom. Student 8 was tested during the 1987-88 term but did not qualify for any special programs. Student 2 has completed the first year at the practicum site and will be referred for testing in the fall term.

CHAPTER V

Recommendations

Results have indicated that this project was successful. For those children who can learn to tell time by the traditional method of textbooks, worksheets, and various kinds of clocks, this strategy is not necessary. However, for those who have difficulty understanding the concept, this method explains time-telling in the simplest of concrete terms. Although mistakes will be made in performing the skill, students will have gained a basic understanding of how the skill is performed.

Since this project presented a different approach to time-telling, a reporter from the local newspaper visited the school, talked with the targeted students, took photographs and printed the story of the clock (Appendix X:95).

This project will remain permanently on the playground of the site (Appendix Y:97). The faculty and staff are aware of its presence and two first grade teachers utilized it during the 1988-89 term.

Reference List

Barson, Alan, and Lois Barson. "Ideas," Arithmetic Teacher. 35. December, 1987: 19-24.

Berger, Kathleen Stassen. The Developing Person, New York: Worth Publishers, Inc., 1980.

Elkind, David."Action in the Classsroom: The Swiss Movement," Theory Into Practice, Spring, 1981: 74-78.

Friedman, Susan G., and Alan M. Hofmeister. "Matching Technology to Content and Learners: A Case Study," Exceptional Children. 51. October, 1984: 130-134.

Growing Years,The. Coast Community College District; 1977. Regents of the University of California; and Mc Graw-Hill, Inc. (16mm., 30 min., color).

Heddens, James. Todays Mathematics. Chicago, Henley-on-Thames, Sydney, Toronto: Science Research Associates, Inc., 1984.

Horak, Virginia M., Willis J. Horak. "Let's Do It: Teaching Time With Slit Clocks," Arithmetic Teacher. January, 1983:8-12.

Kamii, Constance. "Leading Primary Education Toward Excellence,"Young Children, September, 1985: 3-9.

Krustchinsky, Rick, and Nancy Larner. "It's About Time," Teaching Exceptional Children. Spring, 1988:40-41.

Lippstreu, Betty Lee, and Marilyn Kay Johnson. "Teaching Time Using the Whole Clock Method," Teaching Exceptional Children, Spring, 1988: 10-12.

Smith, Patricia E. One Hand at a Time. Palo Alto: Dale Seymour Publications, 1987.

Third Grade Math Curriculum

PROGRAM OBJECTIVES
MATHEMATICS
Continued

Compares numbers less than 1,000 using =, >, <

Puts in order any three whole numbers less than 100

Identifies standard numerals for expanded numerals less than 1000

Reads and writes the numerals for any given whole number through 1000

Identifies place value of a digit to 999

Tells time to the hour and half-hour

Identifies the number of objects in a set of no more than 500 objects

Identifies the ordinal position of any object in a set of 11 through 50 objects using a reference point

Identifies standard numerals for expanded numerals to 9,999

Compares numbers using less than, greater than, and equal to 9,999

Identifies standard numerals and word names to 999,999

Identifies place value of a digit to 999,999

Reads and writes money values through $1

Identifies money values less than $10 in the standard dollars and cents form

Identifies time in 1 and 5 minute intervals

Determines equivalent amounts of up to $1 using coins

Adds facts to sum 10

Adds facts to sum 18

Subtracts facts from 10 or less

Subtracts facts from 18 or less

Finds sums using order and grouping properties

Identifies related sentences for given addition and subtraction sentences

Completes related sentences

Makes true number sentences using equal to, greater than, and less than signs

Adds and subtracts with input-output tables

Chooses a number sentence for a word problem

Adds a 1 or 2-digit number to a 2-digit number with no regrouping

Adds 1 or 2-digit number to a 2-digit number with regrouping

Adds two 3-digit numbers without regrouping

Adds two 3-digit numbers with regrouping

Adds a 1, 2, or 3-digit number to a 3-digit number

Adds three 1, 2, or 3-digit numbers with regrouping

Adds, using money notation

Chooses a number sentence for a word problem

Solves word problems

Subtracts 2 and 3-digit numbers without regrouping

Subtracts a 1-digit from a 3-digit number with regrouping

Subtracts any two 2-digit numbers with only one regrouping

Subtracts 2 and 3-digit numbers with regrouping

Subtracts, using money notation

Subtracts from a number having zero tens by regrouping

Rounds numbers to nearest ten and hundred, and rounds coins to the nearest dollar

Estimates sums and differences

Estimates to solve money problems

Determines solutions to real-world problems involving addition of up to two 2-digit numbers

Determines solutions to real-world problems involving subtraction of two 2-digit numbers with no regrouping

Determines the change to be received from up to $20 after the purchase of two items

Measures length to the nearest centimeter

Converts centimeters and meters

Converts liters, half-liters, and quarter-liters

Converts gallons, quarts, pints, and cups

Converts grams and kilograms and vice versa

Converts pounds and ounces

Reads a thermometer

Solves word problems using addition and subtraction when some problems have extra information

Measures length to the nearest inch

Converts inches, feet, and yards

Writes basic multiplication facts, products through 25

Divides basic facts, quotient 5 or less

Chooses related sentences (addition or multiplication)

Finds missing factors

Chooses related sentence (division or multiplication)

Determines time, given the number of minutes before or after a given time

Solves word problems with missing information

Identifies odd and even numbers

Multiplies basic facts for 2, 3, 4

Multiplies basic facts for 5, 6, 7

Multiplies basic facts for 8, 9

Writes basic division facts, products through 36

Divides by 5, 6, 7

Divides by 8, 9

Rounds money to the nearest dollar

Multiplies 2-digit number by 1-digit number with no regrouping

Multiplies 2-digit number by 1-digit number with regrouping

Multiplies multiples of 100

Multiplies 3-digit number by 1-digit number with no regrouping

Multiplies 3-digit number by 1-digit number regrouping once

Multiplies 3-digit number by 1-digit number regrouping twice

Solves problems by finding information in a chart

Solves word problems using mathematical operations

Divides multiples of 10 and 100

Divides a 2-digit number by a 1-digit number, with and without remainders

Divides a 3-digit number by a 1-digit number, quotient less than 100, with and without remainders

Divides a 3-digit number by a 1-digit number, quotient greater than 100, with and without remainders

Adds hours and minutes

Solves problems dealing with amount saved at sale price

Solves word problems using division

Identifies parts of a whole as a fraction

Compares fractions using >, <, =

Identifies one-half, one-third, or one-fourth of a set having no more than 8 objects, with no remainders

Identifies equivalent fractional parts of regions that have been separated into halves, thirds, or fourths

Finds information using a pictograph

Solves problems using bar graphs, vertical and horizontal

Identifies line segment, line, ray

Identifies diameter, radius, or center of circles

Identifies rectangles, squares, and triangles

Selects figures having lines of symmetry

Finds perimeter of a rectangle, square, and triangle

Finds area of a rectangle, a square, and shapes made of individual squares

Finds volume of a rectangular solid

Chooses correct operation to solve word problems

Adds, using 4-digit numbers without renaming

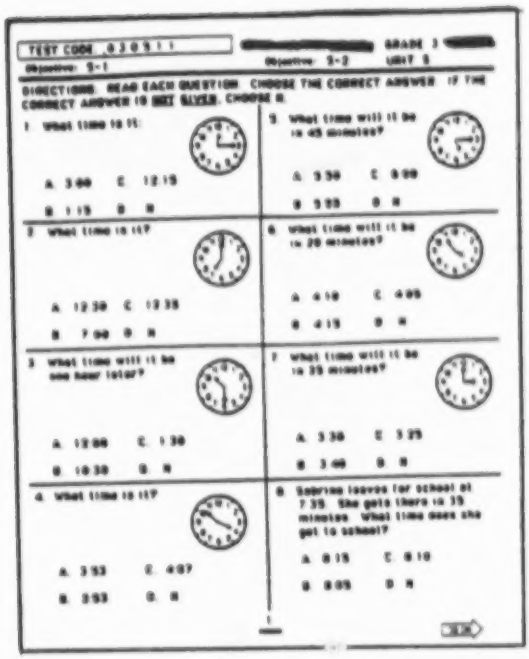
Adds, using 4-digit numbers with renaming

Subtracts, using 4-digit numbers without renaming

Subtracts, using 4-digit numbers with renaming

Identifies the probability of choosing one object, when there are two, three, or four possibilities

County Standardized Test



Questions and Responses

Test 5-1

Question	Correct	Incorrect
1.	56	5
2.	59	2
3.	38	23
4.	19	42

23 failed to pass 75%

Test 5-2

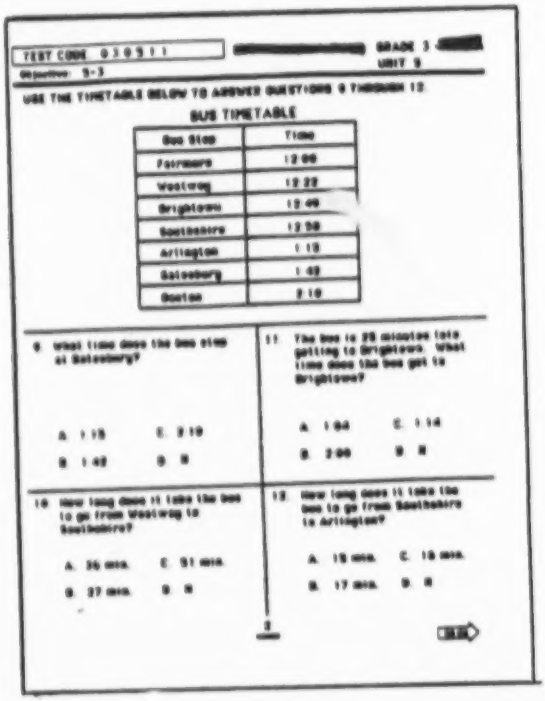
5.	39	22
6.	26	35
7.	44	17
8.	24	37

28 failed to pass 75%

Test 5-3

Question	Correct	Incorrect
9.	55	6
10.	31	30
11.	23	38
12.	20	41

42 failed to pass 75%



TEACHER SURVEY
on
Math Skills

In your opinion, which math skills are the most difficult for your students to understand. List those skills.

_____ _____

_____ _____

_____ _____

_____ _____

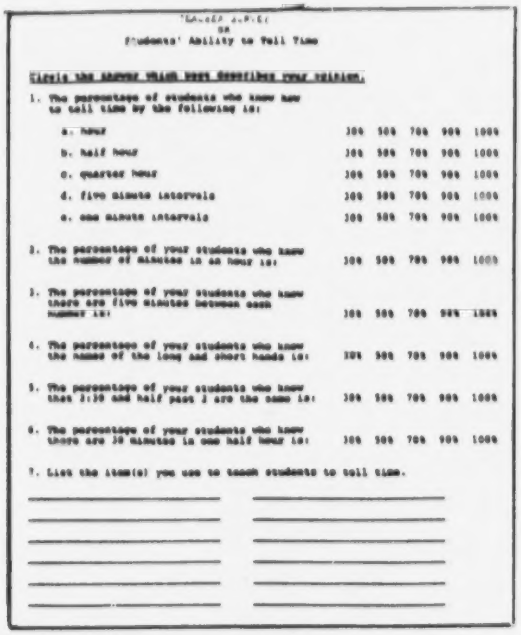
_____ _____

RESULTS OF SURVEY

SKILL	NO. TIMES LISTED
Telling Time	6
Money	6
Problem Solving	4
Missing Addends	3
> <	3
Subtraction Facts	1

APPENDIX D

Teacher Survey on Students' Ability to Tell Time



[illegible]
on
Students' Ability to Tell Time

Circle the answer which best describes your opinion.

1. The percentage of students who know how to tell time by the following is:

a. hour	30%	50%	70%	90%	100%
b. half hour	30%	50%	70%	90%	100%
c. quarter hour	30%	50%	70%	90%	100%
d. five minute intervals	30%	50%	70%	90%	100%
e. one minute intervals	30%	50%	70%	90%	100%

2. The percentage of your students who know the number of minutes in an hour is: 30% 50% 70% 90% 100%

3. The percentage of your students who know there are five minutes between each number is: 30% 50% 70% 90% 100%

4. The percentage of your students who know the names of the long and short hands is: 30% 50% 70% 90% 100%

5. The percentage of your students who know that 3:30 and half past 3 are the same is: 30% 50% 70% 90% 100%

6. The percentage of your students who know there are 30 minutes in one half hour is: 30% 50% 70% 90% 100%

7. List the item(s) you use to teach students to tell time.

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

RESULTS OF SURVEY

Number of Teachers Responding to Percentages

Question No.		30%	50%	70%	90%	100%
1.	a.			1	4	1
	b.			5	1	
	c.	5	1			
	d.	5	1			
	e.	5	1			
2.			3	2	1	
3.		2	3			1
4.		1	1		3	1
5.		1	3	1	1	
6.			3	1	2	

Results of Items Used to Teach Time

No. of Teachers	Items
6	Worksheets
6	Textbooks
6	Judy Clocks
4	Oral Games
3	Individual Clocks
2	Beads
2	Quarters
2	Real Clocks
1	Hour-Only Clocks
1	Digital
1	Puzzles

Letter For Parent Permission

[redacted]

November 8, 1988

Dear Parents:

For those of you who do not know me, I am presently employed at [redacted] as Primary Specialist. In fact, I have been a teacher here since the school's beginning. I am also enrolled as a graduate student at Nova University.

In order to complete my master's degree in Early Childhood Education, I will need the help of some second and third grade students. I will be working with these children on telling time. My plans have been discussed with [redacted] and I have her approval.

I do need the help of your child and I will be more than happy to answer any questions or concerns you may have. However, if you object to your child participating, please contact me or the school as soon as possible. The phone number is 786-3500.

Sincerely,

Janie Irington

Janie Irington
Primary Specialist

STUDENT SURVEY
on
Telling Time

My name is _____

Circle the answer that best describes what you think.

1. I can tell time on a clock that has hands. Yes No
2. I can tell time on a "hand clock" by the:
   a. hour Yes No
   b. half hour Yes No
   c. quarter hour Yes No
   d. five minute intervals Yes No
   e. one minute intervals Yes No
3. Are both hands on a clock the same size? Yes No
4. Are 2:30 and half past 2 the same? Yes No

Fill in the blanks with the correct answer.

5. The short hand on a clock is called the _____ hand.
6. The long hand on a clock is called the _____ hand.
7. There are _____ minutes in an hour.
8. There are _____ minutes between each number.
9. There are _____ numbers on a clock.
10. The number that is half way around the clock is the _____.

RESULTS OF SURVEY
NUMBER OF STUDENT RESPONSES

Question		Yes	No
1.		51	16
2.	a.	61	6
	b.	52	15
	c.	43	24
	d.	46	21
	e.	49	18
3.		4	63
4.		45	22

Question	Correct	Incorrect
5.	45	22
6.	45	22
7.	47	20
8.	40	27
9.	59	8
10.	29	38

RESULTS OF SURVEY

Question	Correct Response
1.	11
2.	42
3.	33

No. Missed	NO. of Children
None	8
1	19
2	5
3	6
4	2
5	12
6	4
7	8
8	3

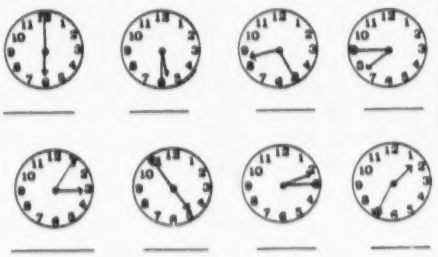
Number of Homes Having:

Hand Clocks	Digital	Even Amount
22	38	9

Write the answer to each questions.

1. The long hand is on the 2 and the short hand is on the 1.
   What time is it? _____
2. The short hand is half way past the 2 and the long hand is on the 6. What time is it? _____
3. The long hand is on the 1 and the short hand is on the 10.
   What time is it? _____

Write the correct time.



_____ _____ _____ _____

_____ _____ _____ _____

How many clocks do you have in your home? _____

How many are "hand clocks"? _____

How many are digital clocks? _____

Tests of Various Types of Conservation

	Start with:	Then:	Ask the child	Preoperational children usually answer
CONSERVATION OF LIQUIDS	Two equal glasses of liquid.	Pour one into a taller, thinner glass.	Which glass contains more?	The taller one
CONSERVATION OF NUMBER	Two equal lines of checkers.	Lengthen the space between one line.	Which line has more checkers?	The longer one
CONSERVATION OF LENGTH	Two sticks of equal length.	Move one stick.	Which stick is longer?	The one that is farther to the right.
CONSERVATION OF AREA	Two identical pieces of cardboard on which are placed the same number of equally-sized blocks.	Rearrange blocks on one piece of cardboard.	Which has more cardboard covered up?	The one with the blocks not touching

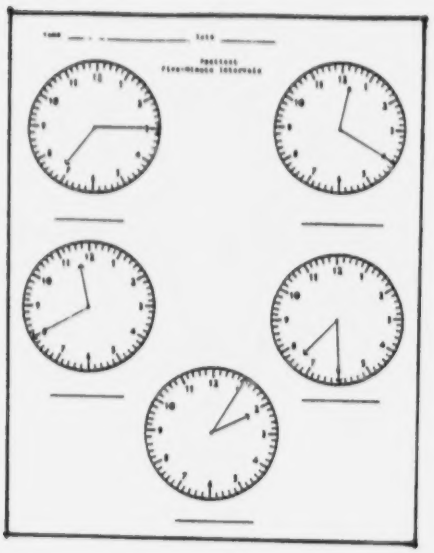
(Berger, 1980:304)

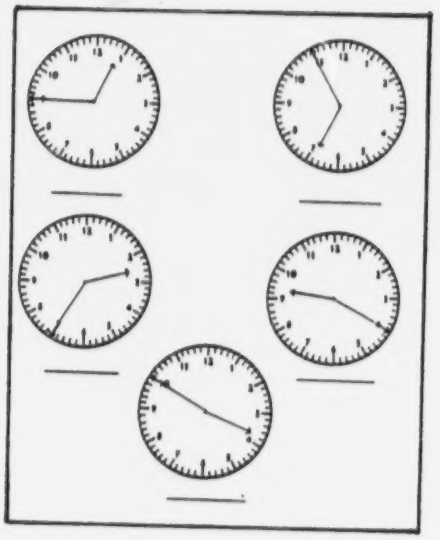
RESULTS OF CONSERVATION TESTS

Students Giving Preoperational Answers

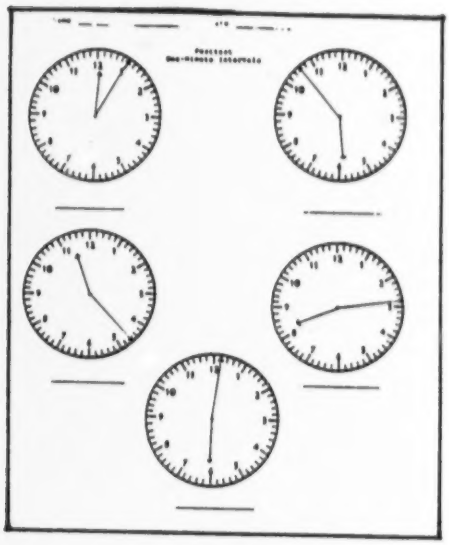
Student	Age	Liquid	Number	Length	Area
1	10	No	No	No	No
2	10	Yes	No	Yes	Yes
3	10	No	No	No	Yes
4	10	No	No	No	No
5	9	No	No	No	No
6	9	Yes	No	Yes	No
7	8	Yes	Yes	Yes	Yes
8	8	No	No	Yes	Yes
9	10	Yes	No	No	No
10	9	Yes	No	No	No
11	9	No	No	Yes	No
12	9	No	No	No	No
13	10	No	Yes	Yes	No
14	9	No	No	No	No
15	8	Yes	No	No	Yes
16	9	No	No	No	Yes
17	10	No	Yes	Yes	Yes
18	8	Yes	Yes	Yes	Yes
19	9	Yes	Yes	Yes	Yes
20	10	Yes	No	Yes	No
21	8	No	No	No	No
22	9	Yes	Yes	Yes	Yes
23	9	No	Yes	No	No
24	10	No	No	No	No
25	9	Yes	No	No	Yes

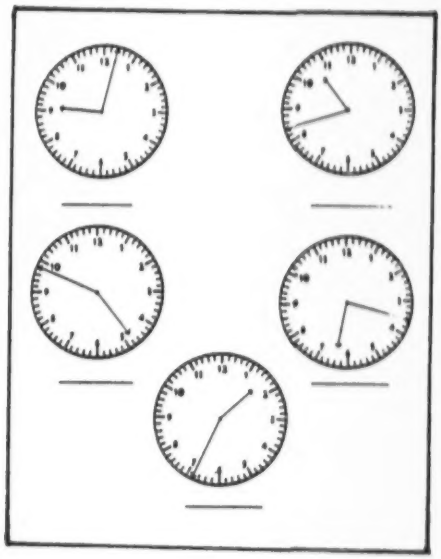
Posttest - Five-Minute Intervals





Posttest - One-Minute Intervals





Discussion on Need For Clocks

Questions	Responses
1. Do we need clocks in our lives today?	All ten students agreed that clocks were needed. The reasons were: (1) People need to get to places on time. (2) People need to know when to get up in the morning. (3) If we did not know the time, we would not know when to go to our special activity or to lunch. (4) The teacher needs to know when it is time to go home from school.
2. Have we always had a need to know the time of day?	Seven students answered "No". One student answered that he thought it was important for people to know the time of day. Another student agreed with "Yeah, that's right". One student had no opinion.
3. Have we always had clocks around to let us know the time of day?	One student answered with "Maybe". Three answered "No". "I don't know" was the answer from four. Two had no opinion.

Clocks did not always look the same as they do today. Long ago, people made marks on the ground where the shadow of a tree fell. The shadow changed as the sun moved in the sky. This was a kind of sundial. Since this way could only be used on sunny days, people began to make sundials from other materials.

People also used water clocks to measure time. This was a large jug filled with water and marked to show the hours. As the water dripped from a hole in the jug, the level went down. The marks measured the amount of water that dripped out in an hour.

Another means of measuring time was to use a sand glass. Time was measured by the amount of time it took the sand to pass through a narrow passage from one part of the container to the other. Many games that are played today contain a small sand glass to measure time.

Clock candles were also used to measure time. Notches and numbers were marked on a candle and as the candle burned, it would tell the number of hours that had passed.

Mechanical clocks, those with a face and hands, were invented about 700 years ago.

In earlier times, peoples' lives were not as busy as they are today. Their lives did not require them to be somewhere at exact, to-the-minute, times. People were not in a hurry. They made their meeting times to be on the hour. This way of living worked very well for them.

Gradually, people became busier and decided that the one-handed clock was not accurate enough. At that time, the minute hand was added to the clock. Peoples' lives soon became busier and busier and the minute hand was not accurate enough. At that time, the second hand was added to the clock.

In today's world, we have clocks with three hands. Do you think there will come a time when another hand will need to be added (Smith, 1987)?

In response to the last question, none of the students answered that adding another hand could be a possibility.

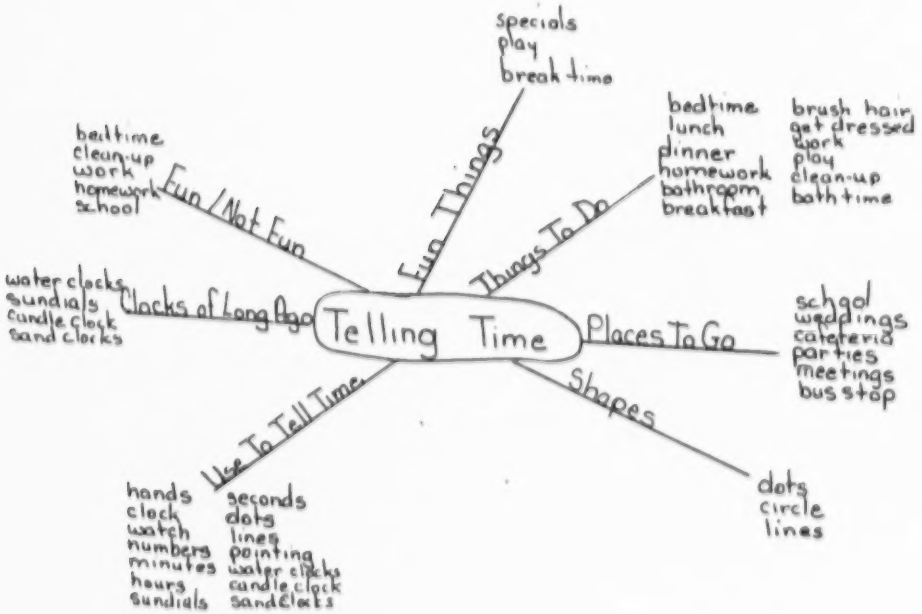
Discussion on Telling Time

Question	Responses
1. Do you remember what you learned about clocks and telling time in the first and second grades?	The students remembered being taught to tell time but no more information could be obtained.
2. How do you tell time?	"I don't," answered one student. "Ask somebody" was the reply from another. Then four more said that they did the same thing. "My mama tells me," said a student. "Me too," answered another. All had digital clocks and relied on them to tell time.
3. What is it about telling time that is difficult for you? Why?	All ten answered that counting minutes was difficult. One reason was that it was "hard" to do. Distinguishing between the two hands caused confusion. It was difficult to remember which hand was the hour hand and which was the minute hand. Always remembering the directions of the hands was difficult for some.
4. How do you know when to leave for school or to go to the bus?	Most relied on another person, a friend or family member. Digital clocks and the position of the clock hands were mentioned.
5. Is it important to be able to tell time? Why?	All agreed that being able to tell time was important. One student remarked that he thought it was "real important." "Then you don't have to ask somebody else," he said.

Semantic Mapping

The following words were associated with telling time:

hands	water clocks	lunch	pointing
clock	candle clock	cafeteria	breakfast
watch	bedtime	break time	play
numbers	sand clocks	homework	weddings
minutes	school	bath time	parties
hours	dinner	bus stop	clean-up
seconds	bath room	meetings	brush hair
circle	sundials	specials	lines
dots	work	get dressed	



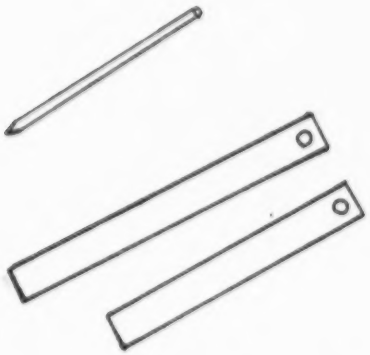
Outside Clock

On the playground, sixty blocks were placed in a circle. Round concrete stones, seven inches in diameter, were placed in the position of numbers. Bricks positioned between the round stones represented minutes. Children could easily step from one brick or stone to another and leap from one round stone to another.

A stake, 40 inches long and one inch in diameter, was placed in the center of the clock. It was driven into the ground in order to attach the hands.

The hands of the clock were made of wood. Both were two inches wide and one-half inch thick. The hour and minute hands were 74 and 84 inches long, respectively. A hole was drilled at the base of each hand for easy attachment to the stake.

The total cost of materials, which included stones, wood and paint, amounted to thirty-seven dollars and sixty-eight cents.



Directions for "Around the World"

Around the World

Although the game is played by a group, only two players compete at a time. All children are seated. The first player goes to the second player and both stand. They are shown a time on the clock and the first one to call out the correct answer is the winner. The loser sits down and the winner goes on to the next player. The same procedure is repeated and the game continues for the amount of time desired.

The object of the game is for one player to "sit down" all the other participants. When this occurs, the player has gone "around the world" and wins a prize.

Results of Using Clocks

MECHANICAL CLOCK RESPONSES OF TIME SHOWN AND TIME CALLED

	First	Second	Third	Fourth
Student 1	2:30/ 2:30	3:10/ 3:10	7:50/7:50	10:58/10:59
Student 2	12:30/ 6:00	10:15/ 3:45	10:40/10:35	
Student 3	12:30/12:30	4:50/10:20	7:02/12:35	9:27/ 5:45
Student 4	4:30/ 4:00	4:05/ 4:12	8:45/ 8:48	10:51/11:51
Student 5	12:30/12:30	1:45/ 1:45	3:02/12:15	4:17/ 4:17
Student 6	6:30/ 6:30	9:10/ 9:10	12:05/12:04	3:33/ 3:31
Student 7	12:30/12:30	10:15/10:15	6:53/ 6:52	3:47/ 3:48
Student 8	6:54/ 7:50	11:25/ 5:10	2:30/ 2:30	

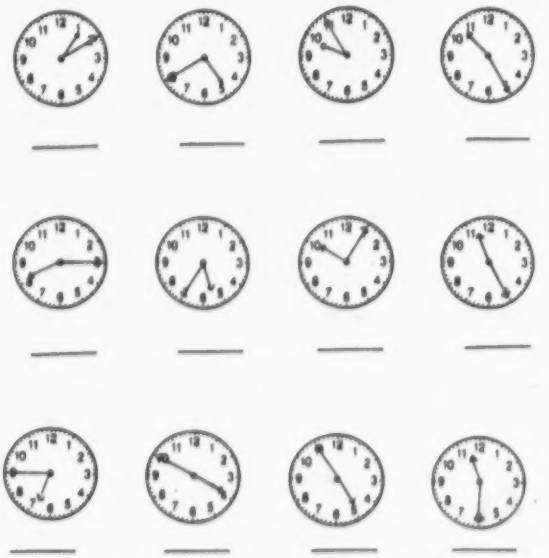
JUDY CLOCK RESPONSES OF TIME SHOWN AND TIME CALLED

	First	Second	Third	Fourth
Student 1	8:09/ 8:09	9:25/ 9:25	10:30/10:30	1:11/ 1:11
Student 2	5:59/ 6:59	9:30/ 9:30	11:14/11:14	12:55/12:55
Student 3	12:59/ 1:59	3:25/ 3:25	4:55/ 5:55	7:07/ 7:07
Student 4	8:13/ 8:13	9:42/ 9:42	11:23/11:23	12:57/ 1:57
Student 5	ABSENT			
Student 6	1:51/ 2:51	3:32/ 3:32	4:25/ 4:25	5:48/ 5:48
Student 7	1:50/ 1:50	11:01/11:01	11:39/11:39	12:29/12:29
Student 8	ABSENT			

Telling Time By Five-Minute Intervals

Name _____ Date _____

Look at the clocks and write the correct time on the lines below.

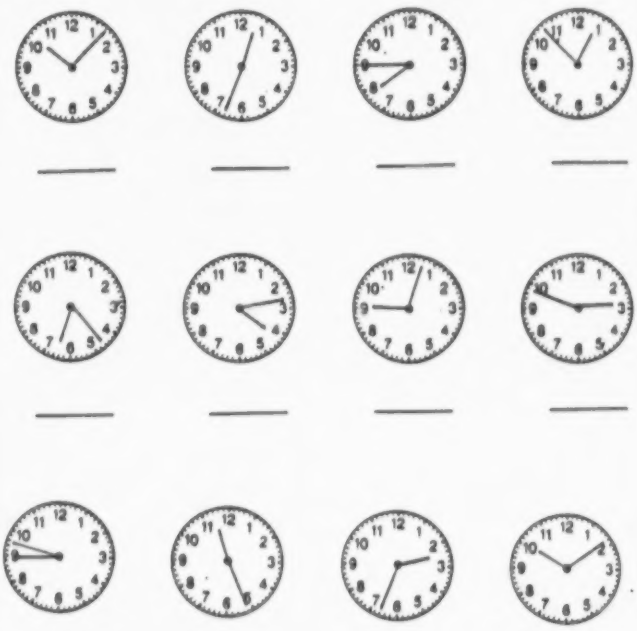


RESULTS NUMBER CORRECT/NUMBER POSSIBLE	
	Five-Minute Intervals
Student 1	11/12
Student 2	2/12
Student 3	Absent
Student 4	12/12
Student 5	12/12
Student 6	10/12
Student 7	11/12
Student 8	8/12

Telling Time By One-Minute Intervals

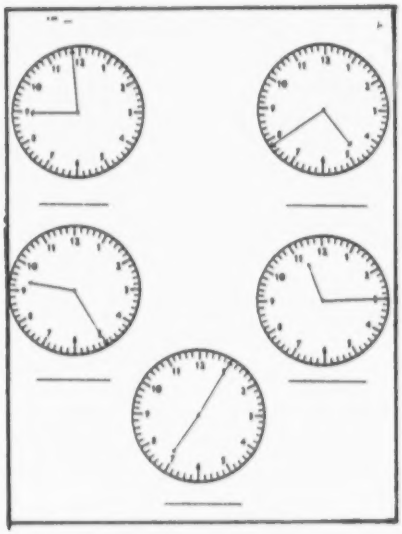
Name _____ Date _____

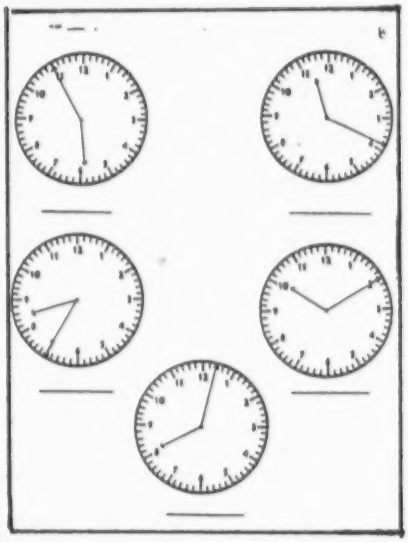
Look at the clocks and write the correct time on the lines below.



RESULTS NUMBER CORRECT/NUMBER POSSIBLE	
One-Minute Intervals	
Student 1	11/12
Student 2	8/12
Student 3	2/12
Student 4	12/12
Student 5	5/12
Student 6	9/12
Student 7	11/12
Student 8	3/12

Telling Time By One and Five Minute Intervals



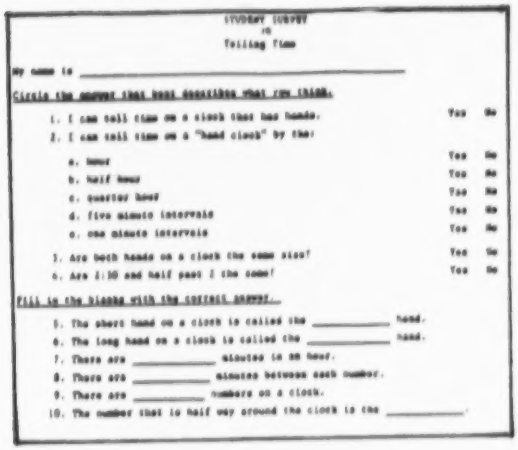


RESULTS Correct/Possible	
Student 1	10/10
Student 2	8/10
Student 3	10/10
Student 4	8/10
Student 5	10/10
Student 6	10/10
Student 7	9/10
Student 8	9/10

APPENDIX T

Second Student Survey 87

Results of Student Survey Administered for Second Time



STUDENT SURVEY
on
Telling Time

My name is _____

Circle the answer that best describes what you think.

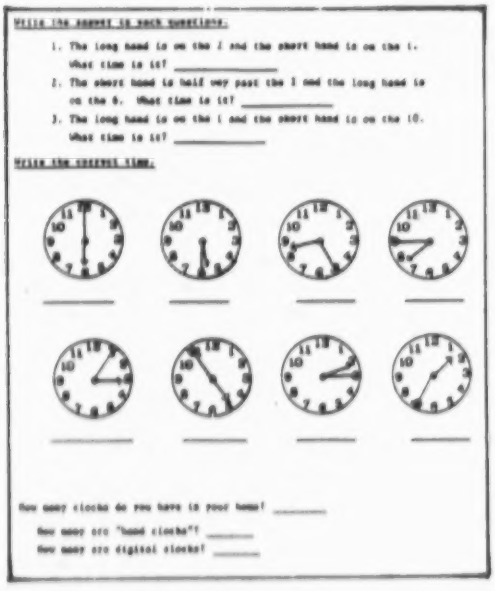
1. I can tell time on a clock that has hands. Yes No
2. I can tell time on a "hand clock" by the:
   a. hour Yes No
   b. half hour Yes No
   c. quarter hour Yes No
   d. five minute intervals Yes No
   e. one minute intervals Yes No
3. Are both hands on a clock the same size? Yes No
4. Are 2:30 and half past 2 the same? Yes No

Fill in the blanks with the correct answer.

5. The short hand on a clock is called the _____ hand.
6. The long hand on a clock is called the _____ hand.
7. There are _____ minutes in an hour.
8. There are _____ minutes between each number.
9. There are _____ numbers on a clock.
10. The number that is half way around the clock is the _____.

RESULTS Correct/Possible	
Student 1	4/4
Student 2	4/4
Student 3	4/4
Student 4	4/4
Student 5	4/4
Student 6	4/4
Student 7	4/4
Student 8	4/4

RESULTS Correct/Possible	
Student 1	8/8
Student 2	8/8
Student 3	6/8
Student 4	8/8
Student 5	8/8
Student 6	8/8
Student 7	8/8
Student 8	7/8



Write the answer to each question.

1. The long hand is on the 2 and the short hand is on the 1. What time is it? _____
2. The short hand is half way past the 3 and the long hand is on the 6. What time is it? _____
3. The long hand is on the 1 and the short hand is on the 10. What time is it? _____

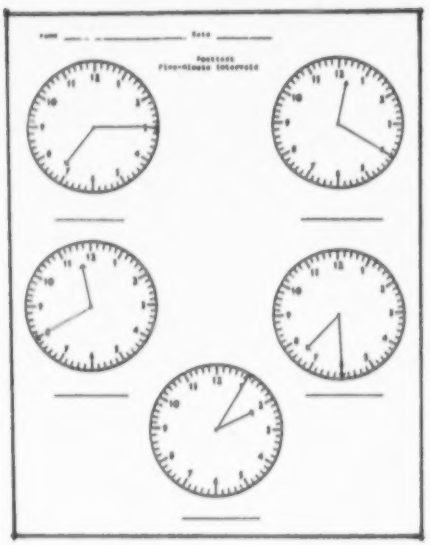
Write the correct time.

How many clocks do you have in your home? _____

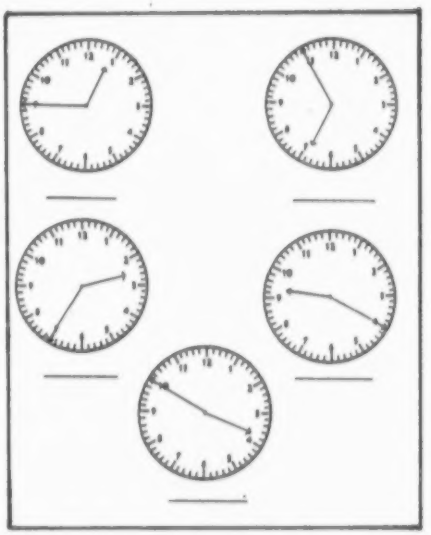
How many are "hand clocks"? _____

How many are digital clocks? _____

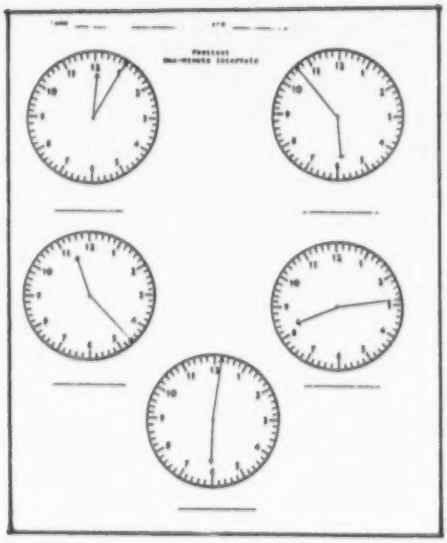
Posttest - Five-Minute Intervals



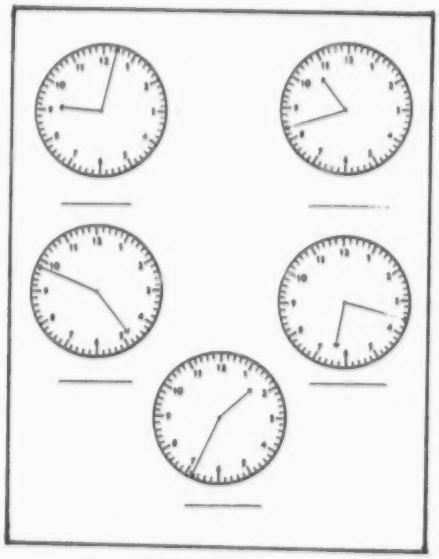
RESULTS	
Correct/Possible	
Student 1	10/10
Student 2	8/10
Student 3	8/10
Student 4	10/10
Student 5	10/10
Student 6	10/10
Student 7	9/10
Student 8	8/10



Posttest - One-Minute Intervals



RESULTS Correct/Possible	
Student 1	10/10
Student 2	8/10
Student 3	8/10
Student 4	10/10
Student 5	10/10
Student 6	10/10
Student 7	10/10
Student 8	9/10



Results of Practicum Objectives

	STUDENT SURVEY							POSTTEST		POSTTEST	
	Objective One			Objective Two				Objective Two 5-Minute Intervals		Objective Three 1-Minute Intervals	
	Pretest	Posttest	Difference in Score	Pretest	Posttest	Difference in Score	Percent of Improvement	Answers Correct / Answers Possible	% Answers Correct	Answers Correct / Answers Possible	% Answers Correct
Student 1	0/4	4/4	100%	2/8	8/8	75%	300	10/10	100	10/10	100
Student 2	0/4	4/4	100%	1/8	8/8	88%	700	8/10	80	8/10	80
Student 3	0/4	4/4	100%	2/8	6/8	50%	400	8/10	80	8/10	80
Student 4	0/4	4/4	100%	2/8	8/8	75%	300	10/10	100	10/10	100
Student 5	0/4	4/4	100%	1/8	8/8	88%	700	10/10	100	10/10	100
Student 6	0/4	4/4	100%	4/8	8/8	50%	100	10/10	100	10/10	100
Student 7	2/4	4/4	50%	3/8	8/8	37%	167	9/10	90	10/10	100
Student 8	0/4	4/4	100%	4/8	7/8	38%	75	8/10	80	9/10	90
Student 9	0/4			2/8	MOVED AFTER SEVEN WEEKS						
Student 10	0/4			2/8	DROPPED OUT AFTER FIRST WEEK						
Student 11	0/4			1/8	MOVED BEFORE IMPLEMENTATION						

SCHOOLS

As time passes, students don't miss a beat

By DEBORAH P. WORK
Education writer

Five months ago, Moses Hamilton wanted nothing more than to be able to tell his father what time it was.

"My dad has to leave for work at 7 p.m. and he would ask me to tell him what time it was so he wouldn't be late," said the Hiaman Elementary School third-grader.

But sometimes Moses had trouble telling time and would miss the mark.

When he counted, he lost track of the minutes, couldn't remember which hand was the hour hand, and never quite knew where it was pointing.

"I always got the time wrong. Once, I told him it was 9:00. But there is no such thing as 9:00, so he had to get up and check for himself," said the 10-year-old. "I had to start looking at the digital clock in order to get it right."

Now, Moses and six other third-graders at the Hiaman elementary school do not need digital clocks to know what time it is, thanks to a life-sized clock fashioned on the school playground.

The clock, which has concrete slabs to mark the hours, bricks to mark the minutes and long wooden arms that the children carry around, is the brainchild of Primary Specialist James Irington.

"Time is a hard concept for children to understand because it is abstract," Irington said. "But if they can step on the bricks and move around the clock, time becomes real for them."

Irington conducted a survey among the school's 70 third-graders and found that telling time was a problem almost half the students shared.

"Children need concrete tools to help them learn. I thought that using tools that the students could handle and manipulate would help solve the problem," said Irington, who researched the concept for a master's degree in early childhood education from Nova University.

He said some youngsters have a easier time learning when they have materials to touch and see, rather than reading a book.

"If you wanted to understand how a clock worked, you would learn more if you had one to take apart and put back together, right?," she said. "I'm just trying to make the abstract real for them."

Seven third-graders began in February, first skipping from brick to brick to verify that there are, in fact, 60 minutes in each hour.

"The project has worked so well that other classes will be coming out to use the clock," she said. "In fact, the first-grade classes have been working on it to get the little ones familiar with the concept of time by moving around the clock."

Among the problems the students worked out with the playground clock were confusion over which direction the hands moved and the difference between the hour and minute hands.

"Before I started working with the big clock, I would get mixed up between the minute and the hour hands," said Laura Crawford, 9. "It can be confusing."

The confusion often cost Laura phone calls from her friends, who she did not know what time to wait for their calls.

Carly Sanders, 10, could list eight in at camp last summer unless she asked someone what time it was. "It was kind of embarrassing," she said.

Jean Williams, 9, said he relied on a digital clock to tell time because he had trouble counting the minutes.

Staff photo/LEAH J. SCHICHTER

Carly Sander, left, and Christina Burrows are part of the clock. Jason Jeffrey and Laura Crawford are in the background.

APPENDIX Y

Photographs of Clock and Students 97

Model Clock
&
Students

Students and Model Clock